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ABSTRACT

Results of the Tennessee Basic Skills Test administered statewide to more than 64,000 grade 8 pupils in April 1980 demonstrate that achievement of pupils with kindergarten background is superior to that of non-kindergarten pupils in mathematics, spelling, language, and reading. The effect was greater for mathematics and language than for reading and spelling. The test assessed achievement with respect to 50 of the 80 objectives defined by Tennessee as minimal basic skills competencies. A separate study of a sample of nearly 6,000 pupils, grades 5-8, revealed that the incidence of retention in grade (non-promotion) is considerably less for pupils with kindergarten background than for pupils without it. The cost of the differential retention incidence is estimated to be nearly $2.5 million annually in Tennessee. (Author/RL)

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Two Tennessee Studies of Kindergarten's Relationship to Grade Retention and Basic Skills Achievement

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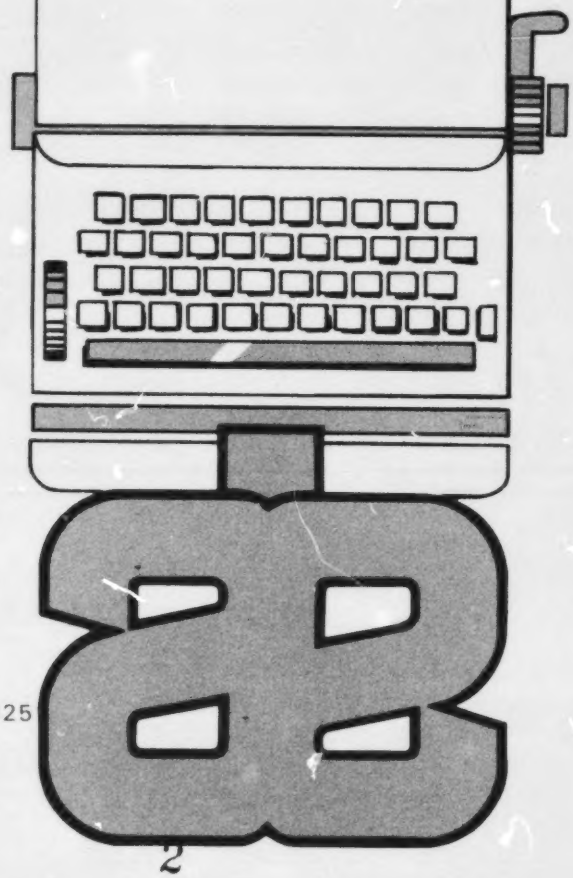
AEL Occasional Paper 003



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TWO TENNESSEE STUDIES OF KINDERGARTEN RELATIONSHIPS TO GRADE RETENTION AND BASIC SKILLS ACHIEVEMENT

A Comparison of Grade Retention and of Basic Skills Test Scores of Pupils Who Did and Who Did Not Attend Kindergarten

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Division of Research and Development
Tennessee Department of Education

AEL Occasional Paper 003

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INTRODUCTION

The State of Tennessee has funded a voluntary kindergarten program in its public schools since 1970. During the past nine years, the number of kindergarten age children who have been enrolled in the program has increased considerably. Of those children entering public schools' first grade in 1971, 18.5% of them had attended public kindergarten the previous year. In 1979, that figure had climbed to 82.2%.

During the first decade of the availability of a public kindergarten program in Tennessee, no data have been collected to ascertain the association between children's kindergarten attendance and subsequent achievement or progress in school. With more than 80% of kindergarten age children now attending kindergarten, the program's educational advantages need to be determined. Legislators, other state government officials, and a sector of the public seek evidence to justify the program's expenditures. In addition, other organizations and individuals seek information to support their advocacy of a mandatory kindergarten program for all children prior to entering first grade. This report documents the first research effort by the State Department of Education to collect evidence that would help determine program effects on basic skills performance and on progress in school.

Tennessee is in a unique position to study the association between pupil achievement in basic skills and pupil attendance in kindergarten. Beginning with the graduating class of 1982, all high school students in Tennessee will be required to pass a proficiency test in basic skills as a requisite for graduation. In preparation for students' meeting the requirement, preliminary proficiency tests were administered to all eighth grade pupils in 1978, 1979, and 1980. Since the same test was administered to all eighth grade pupils

in the state in a given year, the Department of Education had a common base of data for studying the association between pupil achievement and pupil kindergarten attendance. In fact, our review of the literature suggests that Tennessee may be the only state that has collected such a massive quantity of data on the kindergarten question on a statewide basis. Other research studies, though sound in design and basically adequate in numbers of subjects, have been conducted with fewer students than in the Tennessee study. Because of this, however, some of the studies were able to control for certain variables, such as socioeconomic status, which was not possible in our study. For this reason, a comparison of the Tennessee findings with other studies would appear to be especially important.

REVIEW OF RELATED LITERATURE

Several research studies lend credence to the hypothesis that preschool or kindergarten experience directly influences later achievement. Begle (1979) reviewed 15 such cases and reported that, while the studies are not unanimous in their findings, they do suggest that preschool experience leads to better mathematics achievement in the early grades. It is unclear, he observed from these studies, just how long this advantage lasts.

Haines (1960) studied two groups of children in Connecticut. One group was from a community without a kindergarten program. The second group was from a community that had operated a kindergarten program for several years. The communities were similar in size, location, and history. In the study, reading and mathematics achievement tests were administered to all pupils in grades one through six. When it was discovered that pupils from the two communities were not comparable in mental ability, pupils were matched on the basis of mental ability to form pairs, reducing to 603 the initial

population of more than 800 subjects. It was found that the group with kindergarten experience scored higher in reading than did the group without kindergarten experience, but the difference between groups was not satisfactorily significant. Mathematics scores were higher in all grades for pupils with kindergarten experience, but they were significantly different (at the 0.01 level) from scores of pupils without kindergarten experience only in grades two and five. These findings suggest that the advantage in mathematics achievement that is associated with kindergarten persists through at least the fifth grade. They further suggest that the effects of kindergarten experience may be stronger in influencing achievement in mathematics than in reading. As will be seen later, the results of our present study are similar.

Lazar and Darlington (1980) report the findings of the Consortium of Longitudinal Studies regarding the effectiveness of Head Start and similar preschool programs. Twelve investigators pooled their data from investigations conducted during the 1960's, and designed a common follow-up study to analyze the effect of preschool experience on later achievement. They reported:

(1) Early education programs significantly reduced the number of children assigned to special education classes. This result held after controlling for the effects of children's IQ scores, sex, ethnic background, and family background. The benefit extended to all participants, regardless of initial abilities or early home backgrounds.

(2) Early childhood programs significantly reduced the number of children retained in grade. The result held true when measures of early childhood characteristics and home background variables were controlled. All children benefitted, regardless of sex, ethnic background, early IQ, and home background.

(3) Early education significantly increased children's scores on fourth grade mathematics tests, and evidence suggested a trend toward increased scores on fourth grade reading tests.

The Coleman study (1966), the Mayeske study (1970), and the Tennessee study, Tennessee Looks at Its Schools: 1977-78, show similar evidence. These studies suggest that pupils who enter first grade with relatively high levels of development carry with them an advantage which, if sustained throughout the school years, would account for a fair amount of variation in achievement by the end of the high school years.

For more than 17 years, Weikart (1979) and his colleagues have conducted a longitudinal study of children who participated in the Perry Preschool Project in Ypsilanti, Michigan. The project was designed to determine whether preschool experience benefits disadvantaged children. Children were selected for study on the basis of family socioeconomic status (low) and IQ scores of 85 or lower, as measured by the Stanford-Binet Intelligence Scale. Children entered the study in five successive, overlapping waves of about 25 children each, beginning in the fall of 1962. Each wave was divided by matching pairs into a group that attended preschool for two years and a group that did not. Each wave of pupils was followed through grade eight. The Stanford-Binet was administered at the end of each school year through grade four; the Wechsler Intelligence Scale was given at the end of the eighth grade, since it was judged to be more suitable for older children than the Binet. The California Achievement Test was given at the end of each school year through the fifth grade and also at the end of the eighth grade. Teacher ratings of pupils' social and emotional maturity were collected annually through the third grade. By spreading the sample over five years, and by analyzing each of the waves separately, the authors claim they were able, in effect, to

replicate the study five times. They reported the same positive effects for each of the five analyses, to wit:

(1) The IQ gains by the experimental group diminished until they matched those of the control group by the end of the third grade. Studies of Head Start children have demonstrated similar results.

(2) In the early grades, differences in achievement between the experimental and control groups were slight, but the differences increased over time. By the end of the eighth grade, the experimental group tested the equivalent of more than one full grade higher than the control group. The experimental group scored significantly higher than the control group on all three sub-tests--reading, language, and mathematics.

(3) By the end of the fourth grade, more than twice (38% versus 17%) as many children from the control group as from the experimental group had been retained in a grade or placed in special education classes.

(4) Teacher ratings of children's social and emotional maturity consistently favored children with preschool experience through the third grade, the last year for which ratings were made. Teachers reported children with preschool experience to be less disruptive, less resentful of criticism, more honest and more friendly than children without preschool experience.

(5) Cost analysis indicated that the savings realized by the reduction in special placements of the preschool children represented a 56% return on the original investment in the project. The authors estimate that the projected, increased lifetime earnings of the preschool children are substantially higher than the entire cost of providing the preschool education.

This author feels that the positive effects of preschool experience may be considerably stronger for children from disadvantaged/low SES family backgrounds than for children from family backgrounds that are middle class or above. Weikart observed that preschool experience is by no means a cure-all. For while the disadvantaged children with preschool experience in his study excelled their counterparts without preschool experience by 1.2 grade equivalents by the end of the eighth grade, they were still one full grade

equivalent behind the achievement expected of non-disadvantaged children with the same IQ's. The author offers that it is possible that children from families of middle-to-higher SES backgrounds bring with them to school an advantage in language and reading (even if only having been read to) that makes preschool experience less influential on their later achievement. The family preschool experience of these same children in mathematics, however, is likely to be more limited than it is in reading or in language. This hypothesis, if confirmed, could explain why studies of the preschool experience of middle class children demonstrate a more positive effect on mathematics achievement than on achievement in reading and in language, whereas Weikart's study of disadvantaged children indicated strong positive effects for all three domains of achievement.

The findings from the several investigations, reviewed above, point to an advantage of preschool educational experience or kindergarten that persists well into elementary school, possibly through grade eight and beyond. Several studies also indicate that the advantage of preschool experience or kindergarten may be stronger in its effect on achievement in mathematics than on achievement in reading.

PURPOSES OF THE STUDY

The results reported here are the findings of two separate, but related, research efforts conducted by the Tennessee Department of Education's Division of Research and Development. The purposes of the investigation were twofold: (1) to determine whether the Basic Skills Test scores of eighth grade pupils who attended kindergarten differed from the scores of those who had not attended kindergarten; and (2) to determine whether the incidence of grade

retention (non-promotion) of pupils who attended kindergarten differs from that of pupils without kindergarten experience.

The null hypotheses of the study were as follows:

(1) The mean score on the eighth grade Basic Skills Test of pupils who attended kindergarten does not differ from that of pupils who did not attend kindergarten.

(2) The incidence of retention in grade (non-promotion) does not differ for pupils with kindergarten experience and for those without kindergarten experience.

COLLECTION OF DATA

Data to test the first hypothesis were collected when the Basic Skills Test was administered to eighth graders in April 1980. Data to test the second hypothesis came from a 1980 research study the Department conducted with 48 schools in 20 school districts to determine the relationship between various school-related factors and pupil achievement in mathematics.

Data Collection: Hypothesis #1

In April 1980, the Basic Skills Test was administered to more than 64,000 eighth grade pupils in Tennessee's public schools. A pupil taking the test was asked to respond to the question, "Did you attend kindergarten?" by blackening on the answer sheet a circle labeled "Yes" or one labeled "No." The typical eighth grader in 1979-80 would have attended kindergarten in the 1971-72 school year.

Each pupil's score was reported by the Tennessee Testing and Evaluation Center as the number of test items answered correctly. Separate mean scores were reported for each of the four sub-tests--mathematics, spelling, language,

and reading. Separate mean scores on each sub-test were determined for all pupils who attended kindergarten and for those who did not. For purposes of statistical analyses, the standard deviation associated with each mean was also determined so that a t-test could be conducted to test the hypotheses that no differences exist between means on each of the sub-tests.

Data Collection: Hypothesis #2

Administration of the Basic Skills Test to eighth graders in 1979 led to the examination of the effect of kindergarten attendance on non-promotions. This relationship came to light during a mathematics achievement study the Department was conducting with 48 schools in 20 school systems throughout the state. The study was being conducted to determine the association between various school-related factors and pupil achievement in mathematics, as indicated by the 1979 Basic Skills Test. Included among the school-related factors being studied were kindergarten attendance and non-promotions to the next grade level. While the data to test the relationship between kindergarten attendance and grade retention are from a sample of schools, the pupils and schools involved in the study were reasonably typical of pupils and schools throughout the state with respect to achievement in basic skills and to kindergarten attendance. This is supported by the finding that, of the nearly 6,000 pupils in the mathematics study, 65.6% of them attended kindergarten. In the 1980 statewide study, 66.0% of all eighth graders reported having attended kindergarten. In fact, the data collection in the math achievement study became the catalyst for including the kindergarten question on the 1980 statewide test.

The mathematics achievement study involved nearly 6,000 pupils in grades five through eight. Schools in the study were selected on the basis of their 1979 mathematics achievement scores. One set of schools had mathematics

achievement scores significantly higher than the state mean; mathematics achievement scores for the other set were significantly below the state mean. Collectively, however, the mean mathematics scores of schools in both sets did not differ from the state mean mathematics score. Schools also were matched on the basis of equivalent mean scores on the reading and language sub-tests. The means of the two sets of schools on these sub-tests did not differ from the state mean.

FINDINGS OF THE STUDY

Data used to test the first hypothesis are presented in Table 1. The mean scores, their differences, the standard deviations, the t-values associated with the differences, and the statistical significance of the difference are shown for each of the four sub-tests of the 1980 Basic Skills Test.

Table 1

Achievement Data on Pupils With and Without Kindergarten Experience

Sub-test	Possible Score	Attended Kindergarten Mean	Attended Kindergarten S.D.	Did Not Attend Kindergarten Mean	Did Not Attend Kindergarten S.D.	Difference in Means	t-value*	Significance
Mathematics	76	54.36	15.31	51.07	15.57	3.2	25.5	<.001
Spelling	24	19.47	4.24	18.71	4.70	0.76	12.3	<.001
Language	56	38.12	11.00	35.44	11.20	2.68	29.0	<.001
Reading	44	36.30	7.64	34.83	8.36	1.47	21.7	<.001
Total Test	200	148.25	**	140.05	**	8.20	**	**
Number of Pupils		42,588		21,948				
Percent of Pupils		66.0%		34.0%				

* A t-value of only 3.3 was necessary to reject the null hypothesis at the 0.001 level of signigicance.

** Standard deviations for total score were not requested from the Testing and Evaluation Center because our primary interest was with differences in sub-test mean scores.
A t-value for total score could not be determined because standard deviations were not available. There can be little doubt, however, that the difference in means for total test is also significant at the 0.001 level of significance.

Data collected to test the second hypothesis are presented in Table 2. A chi-square test for the difference in the incidence of retention of pupils who did and who did not attend kindergarten yielded a chi-square value of 131.8. A value of only 10.8 is required (with one degree of freedom) to reject the null hypothesis at the 0.001 level of significance.

Table 2

Actual and Expected Incidence of Grade Retention Among Pupils Who Did and Who Did Not Attend Kindergarten

Retention Status	Frequency	Attended Kindergarten Yes	No	Total
Retained in at Least One Grade	Actual	639	595	1,234
	Expected	809	425	
Never Retained in Grade Level	Actual	3,162	1,399	4,561
	Expected	2,992	1,569	
TOTAL		3,801	1,994	5,795

DISCUSSION OF RESULTS

Achievement and Kindergarten Attendance

On the surface, differences in the mean scores on the eighth grade Basic Skills Test of pupils who did and who did not attend kindergarten appear not to be great (see Table 1). However, one must keep in mind that the means represent the scores of more than 42,000 pupils who attended kindergarten and of nearly 22,000 who did not. From a statistical point of

view, the results are highly significant; t-values varied from three to nine times greater than was necessary in order to reject the null hypothesis at the 0.001 level of significance. From a practical point of view, the difference in the mean scores for the total test was 8.2 test items. Simple calculation reveals that pupils who attended kindergarten correctly answered, collectively, almost 350,000 test items more than they would have if their scores had not differed from those of pupils without kindergarten experience (8.2 test items x 42,588 kindergarten attendees). The mean total test score of pupils with kindergarten background was approximately 6% higher than that of pupils without kindergarten.

To this point, no casual relationship has been inferred between test score differences and kindergarten attendance. Indeed, caution is called for in drawing such an inference. The author offers two hypotheses that may account for differences in test scores:

> Hypothesis A: Test score differences are the effects of gains in cognitive, affective, and motor skill development that result from kindergarten experience.
>
> Hypothesis B: Test score differences are the effects of socio-economic status; that is, the effects of the nurturance, encouragement, and the value placed on educational achievement, all of which are typically more characteristic of homes of higher socio-economic status than of homes of lower socioeconomic status.

Evidence that is presently available is insufficient to establish the validity of either hypothesis. For the Tennessee study, it is probable that the effect is, in part, explainable by both hypotheses.

It has been argued that parents who place high value on educational achievement and who are convinced of the value of preschool learning experiences are more likely than others to provide the kindergarten option for their children. In Tennessee in 1971-72, some of these parents may

have paid tuition for private kindergarten because of geographical convenience or lack of availability of a public kindergarten program. Also, at that time, it was necessary in many school districts for parents to provide private transportation for their kindergarten children. These efforts required a commitment to the value of preschool education. And the parents who made these efforts are likely also to be ones who nurture, encourage, and instill in their own children the values that contribute to educational achievement throughout their school career.

Therefore, there is clearly an argument in favor of the socioecomonic hypothesis. The argument is weakened, however, by the fact that 66% of the total 1980 eighth grade population reported having attended kindergarten. The upper and upper-middle socioeconomic classes of Tennessee families represent far less than two-thirds of all families in the state. Undoubtedly, part of the advantage held by kindergarten attendees eight years after attending kindergarten is due to the developmental gains made during their kindergarten experience.

The achievement of eighth grade pupils across the state was measured solely in terms of 50 basic skills objectives which the Basic Skills Test was designed to measure. One may assume that any main effects of kindergarten experience extend to learning domains beyond those 50 objectives. Tennessee has defined 80 basic skills objectives, but at a given time tests only 50 of them (four test items per objective) selected at random from among the 80 objectives. Thus, one may assume that pupils who attended kindergarten hold some advantage over those who did not on the 30 unmeasured objectives. Additionally, local schools teach for a broad range of objectives beyond the 80 basic skills objectives defined by the state as minimum. Again,

one may assume that any advantage accruing to pupils with kindergarten experience extends, to some extent at least, into that broad domain of objectives. In short, the results of the Basic Skills Test almost surely represent only a small sample of the potential benefits that may be realized as a result of kindergarten attendance.

Retention and Kindergarten Experience

Pupils who attend kindergarten in Tennessee are retained in grade with an incidence that is significantly lower than that of their peers who did not attend kindergarten. Of those pupils in our mathematics achievement sample who attended kindergarten, 17% of them failed to be promoted in at least one grade, whereas 30% of those pupils who did not attend kindergarten were retained in at least one grade. Conversely, of those who attended kindergarten, 83% were never retained in grade, but only 70% of the non-kindergarten pupils were never retained. From a separate projection study, our estimate is that, on a statewide basis, more than 9,000 more non-promotions have occurred among the Grade 5-8 population of non-kindergarten pupils of 1979-80 during the course of their school careers than would be expected if their retention rate were the same as that of kindergarten pupils.

Financial and Psychological Costs

Any consideration of the costs and benefits of a compulsory kindergarten program must take into account the eventual and considerable offset in costs that is presently incurred by the greater-than-expected grade repetitions by children without kindergarten education. The cost of the differential retention incidence is estimated to be about $2.5 million in Tennessee at the present time. Additionally, as was shown in Table 1,

one must consider that the school achievement of pupils with kindergarten background is superior to that of non-kindergarten pupils. The advantage in achievement held by kindergarten attendees would appear to be exceptionally strong in the early grades for its effects still to be statistically significant by the end of the eighth grade. One might expect the effects of kindergarten development to diminish somewhat with time for some pupils; at the same time, one might expect many non-kindergarten children of average or above-average ability to catch-up or close the achievement gap between themselves and some of their kindergarten peers over the course of eight years of elementary school education. It should be noted, however, that in his study of children with and without preschool education, Weikart found that the achievement gap between the two groups increased as they progressed through the elementary school grades.

A further advantage of increasing the prevalence of kindergarten education is immeasurable, but of utmost significance. To the extent that kindergarten experience results in improved achievement and reduces the need for pupils to be "failed," it can help reduce the incalculable psychological damage to our children--the damaging scars of lowered self-esteem, of feelings of unworthiness, of reduced motivation to achieve, of lowering of goals, of some abandonment of "can do" attitudes, and of some loss of feelings that the control of one's destiny rests to a large extent in one's own hands. The reduction of these psychological effects, the expected improvement in school achievement, and the offset in costs by the more than $2 million now spent annually by Tennessee on "unnecessary" retention of pupils in grade, speak convincingly to the need and justification of universal kindergarten attendance.

SUMMARY

The results of the Basic Skills Test administered statewide to more than 64,000 eighth grade pupils in April 1980 demonstrate that achievement of pupils with kindergarten background is superior to that of non-kindergarten pupils in mathematics, in spelling, in language, and in reading. The effect was greater for mathematics and language than for reading and spelling. The test assessed achievement with respect to 50 of the 80 objectives defined by the state as minimal basic skills competencies. One may assume some advantage on behalf of kindergarten attendees on the 30 unmeasured objectives and on a broad domain of objectives extending beyond the 80 basic skills objectives.

A separate study of a sample of nearly 6,000 pupils, grades five through eight, revealed that the incidence of retention in grade (non-promotion) is considerably less for pupils with kindergarten background than for pupils without it. Our estimate is that among the state's 1979-80 fifth-eighth grade population of students without kindergarten experience, more than 9,000 retentions have occurred during their school careers than would be expected, if their retention rate were the same as that for kindergarten pupils. The cost of the differential retention incidence is sizeable. It is estimated to be nearly $2.5 million annually in Tennessee. Any consideration of the costs and benefits of a compulsory kindergarten program must take into account the eventual and considerable offset in costs that is presently incurred in funding the greater-than-expected grade repetitions by pupils without kindergarten education. It must also take into account the superior achievement of pupils with kindergarten background and the reduction in psychological damage to pupils whose "failures" may be averted.

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